



# **Head Injury in Anticoagulated Patients**

# Objectives

- Reduce the time from patient presentation to reversal of anticoagulation in patients with intracranial hemorrhage who are on chronic warfarin therapy
- Reduce morbidity and mortality in this distinct, but growing population

# Hemostasis – Cessation of Bleeding

Hemostasis can be divided into primary and secondary phases.

Primary hemostasis involves the initial formation of clot, characterized by the adherence of platelets to the damaged vessel wall. Secondary hemostasis involves thrombin generation through the “coagulation cascade,” with the ultimate deposition and cross-linking of fibrin. The combination of platelet aggregation, fibrin deposition and cross-linking results in the clinically observed stable clot. Without platelets, the fibrin mesh is weak and conversely, without the cross-linked fibrin scaffolding, platelets alone cannot provide adequate hemostasis.

# Effect of Trauma

Shock, trauma and burns cause release of thromboplastic substances that increase thrombin formation and consumption of coagulation factors. They can also lead to thrombocytopenia (abnormal decrease in number of platelets).

In addition, inadequate tissue perfusion incites the inflammatory response, which leads to coagulopathy.

# Background

- The number of patients using warfarin has increased
- Head injury in anticoagulated patients is rapidly becoming a major cause of death, often resulting from a fall
- Use of warfarin significantly predicts poor outcomes in patients with traumatic intracranial hemorrhage (ICH)
- Many patients initially present with minimal neurological symptoms and minor intracranial hemorrhage which progresses to a moribund and ultimately fatal hemorrhage while awaiting diagnosis and initiation of treatment
- Rapid confirmation of ICH with expedited head CT scan combined with prompt reversal of anticoagulation has been shown to decrease progression of ICH and reduce mortality

# Background

- The triad of anticoagulation with warfarin, age >65 and trauma is considered to be associated with high mortality, up to 50% in some studies
- Among patients 55 years of age or older who present with closed head injury, the use of warfarin before trauma appears to be associated with a higher frequency of isolated head trauma, more severe head trauma and a higher likelihood of death
- Pennsylvania study analyzed 1493 adult blunt head trauma patients, 159 of these warfarin-anticoagulated - showed mortality in anticoagulated group 23.9% vs. 4.9% in non-anticoagulated group - Both mortality and the occurrence of ICH after head trauma were significantly increased with higher INR

# Demographics

- In Missoula and the 7 surrounding counties, the number of elderly (65+) has grown 16% in the last 6 years
- The numbers of elderly are expected to continue to be higher than historical averages for the next 20 to 40 years
- It is estimated that in 20 years, the elderly will constitute ~21% of the U.S. population (unless, of course, Obama's death panels get real busy)
- It is projected that by 2050 there will be a 2.5-fold increase in the number of adults with atrial fibrillation



# Tests

PT: Add thromboplastin (containing tissue factor, phospholipids and calcium) to citrated plasma and measuring the time in seconds until a fibrin clot is formed compared to a control. Used to monitor warfarin therapy

PTT: Add partial thromboplastin (mixture of phospholipids), an activating substance and calcium chloride to citrated plasma. Used to monitor heparin therapy

Platelet Count: Quantitative measure of circulating platelets.

Counts  $<50,000/\text{mm}^3$  increase bleeding from cut surfaces and counts  $<20,000/\text{mm}^3$  may be associated with spontaneous bleeding.



# INR

Used to adjust for individual laboratory variation in the PT. The thromboplastin used in individual labs is thus calibrated against a reference thromboplastin.

- Normal: 0.8-1.3
- Normal on coumadin: 2-3
- The higher the INR, the greater the risk of bleeding

# Harborview Protocol

Regional effort led by:

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## Inclusion criteria:

The protocol applies to all adult (18 or older) warfarin anticoagulated trauma patients deemed at risk for intracranial injury. This includes all warfarin anticoagulated patients with blunt mechanisms of trauma, including falls from same level (ground level fall), which have one of the following:

- Any loss of consciousness after trauma
- Any mental status changes after trauma
- History of direct impact to the head or neck
- Any signs of external injury to head or neck such as abrasion or ecchymosis

# Harborview Protocol

## Exclusion criteria:

- Patients who are transferred from an outside facility with diagnosis of intracranial hemorrhage for treatment
- Hospice patients
- Patients that are part of the trauma code or hemodynamically unstable patients that may need other life-sustaining procedures

# Harborview Protocol

## **Definition:**

Intracranial hemorrhage includes epidural hematoma, subdural hematoma, subarachnoid hemorrhage, petechial hemorrhage, and cerebral contusion or shear injury at risk for bleeding

# Harborview Protocol

## Diagnosis:

- Identification of warfarin use through triage process
- Triage directly to treatment area
- Emergent, prioritized head CT scan
- Emergent evaluation by ED physician
- Stat coag screen including PT, INR, Type & Screen
- Immediate head CT interpretation with call back to ED MD
- At same time CT ordered, FFP ordered - St. Vincent's in Billings does not call for thawing of FFP until ICH diagnosed by CT

# Harborview Protocol

## Treatment:

- Patients with diagnosis ICH rapidly given 2 units FFP and 10 mg vitamin K IV
- Blood bank prepares 2 additional units of ABO compatible FFP which is rapidly infused as soon as it is available
- Appropriate surgical consultation, including neurosurgical consultation should be obtained
- PT and INR values are regularly followed and further doses of FFP and vitamin K are administered as indicated
- Appropriate treatment of trauma patients supersedes this protocol. As such, life-saving maneuvers, such as endotracheal intubation and other required treatments (including transfer to definitive care site) should not be delayed

# Experience of Others

Some other facilities that have instituted similar protocols have seen significant decreases from the time of patient presentation to the time of anticoagulation reversal

Some report that, pre-protocol, it took up to 4 hours for this process to be initiated

Post-protocol, most patients were fully anticoagulated within 4 hours